

(Criteria B practice 1) A game about subtraction **Solution**

Instructions

Level 1-2

1. Solve the following subtractions

$$381-183=198$$

$$632-236=396$$

$$732-237=495$$

Level 3-4

2. Explore the operations and answers. Then explain your findings using words and a general rule.

The operation is always subtraction.

It is 3-digit number subtracting 3-digit number.

The hundreds digit is always bigger than the units digit.

The answer of the middle number (tens digit) will always be "9".

The answer of the first number (hundreds digit) is always the difference of the two hundreds digit minus one.

The answer of the third number (unit digit) can be found simply by minus the answer of the hundreds digit by 9.

As conclusion my findings is:

If the hundreds digit of a three digit number is always bigger than its units digit and if we swap the hundreds and units digit of this number to form another two digit number, then the difference of these two three digit numbers much follow the following rules:

The answer of the middle number (tens digit) will always be "9".

The answer of the first number (hundreds digit) is always the difference of the two hundreds digit minus one.

The answer of the third number (unit digit) can be found simply by minus the answer of the hundreds digit by 9.

Level 5-6

3. Justify that your general rule works for any case.

I am going to justify my general rule by using more examples:

Example 1: $786-687=99$

(Answer of the hundreds digit is $7-6-1=0$, the tens digit is always 9 and the last digit is $9-0=9$)

Example 2: $962-269=693$

(Answer of the hundreds digit is $9-2-1=6$, the tens digit is always 9 and the last digit is $9-6=3$)

Example 3: $431-134=297$

(Answer of the hundreds digit is $4-1-1=2$, the tens digit is always 9 and the last digit is $9-2=7$)

I have successfully justify my general rule is correction by the above examples.

Level 7-8

4. Write instructions to explain to your parents how to use your finding as a game. Use mathematical terminology and remember to write a logical, concise and complete explanation.

A game about subtraction:

Instruction:

Player A writes a three-digit number whose middle number must be 9 and the first and third number's sum is 9.

Player B needs to find the two three-digit numbers whose difference is the number that A has written.

Player B can ask player A questions and player A can only give 1 hint at a time.

If player B cannot find out the answer and 3 hints have been given already, then he lose the game.

Another player try.

Player A lose when any player can find out more then 1 correct equation for him.

(Hints 1: The 3 different digits used in the two 3 digit numbers must be the same.

Hints 2: The middle digit of the two numbers is always the same.

Hints 3: The hundreds digit is bigger than the units digit.)

(Criteria B practice 2) Bacteria grown **Solution**

Instructions

Level 1-2

1. Bacteria grow very fast. If 1 cell will split into 2 cells every day. How many bacteria will be there on day 5 and day 6?

There are 16 bacteria on day 5 and 32 bacteria on day 6.

Level 3-4

2. Draw a table as follow and explain the general rule you use to find the answer for question 1.

No. of day (d)	1	2	3	4	5	6	n	10
No. of bacteria (B)	1	2	4	8	16	32		512
Rules	1	2	$2 \times 2 = 4$	$4 \times 2 = 8$	$8 \times 2 = 16$	$16 \times 2 = 32$		
		$2 = 2^1$	$2 \times 2 = 2^2$	$2 \times 2 \times 2 = 2^3$	$2 \times 2 \times 2 \times 2 = 2^4$	$2 \times 2 \times 2 \times 2 \times 2 = 2^5$	$2 \times 2 \times 2 \times \dots = 2^{n-1}$	2^9

**I time the previous number (the bacteria of yesterday) by 2 to find today's number of bacteria.
Or I multiply 2 by (the number of day - 1) times to find the number of bacteria for a certain day.**

Level 5-6

3. Justify that your general rule works for any case.

When it is 6 days I times 2, 5 times:

$$2 \times 2 \times 2 \times 2 \times 2 = 32$$

When it is 10 days I times 2, $10 - 1 = 9$ times:

$$2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 512$$

Level 7-8

4. Express the relationship of No. of bacteria (B) and number of day (d) in mathematical formula.

$$B = 2 \times 2 \times 2 \times \dots$$



Multiply 2 (d-1) times

$$\text{Or } B = 2^{d-1}$$